

PAVING OPERATIONS

CHAPTER 7

TYPES

This chapter covers the construction of asphalt and concrete paving, curbs, and walks.

EQUIPMENT

The selection of equipment affects the number of workers required for paving operations. The use of transit-mixer trucks rather than paving mixers will usually increase the man-hours required to construct paving. Placing, spreading, and finishing equipment should be sized, whenever possible, to the plant equipment. If the paving equipment cannot handle the plant output, the plant will be idle part of the time wait-

ing for the paving crew. If the plant output is less than the paving equipment can handle, the paving crew will be idle part of the time waiting for the plant. With some equipment, it is possible to cut the crew size and slow the paving operation to the plant capacity. However, this is not always possible and certainly is not efficient. The estimator should know what equipment will be used in order to consider all factors.

ASPHALT

Construction of asphalt paving includes heating asphalt, marking pavement edges, brooming, priming, spreading and finishing asphaltic concrete, rolling asphaltic concrete, applying seal coat, applying tack coat, loading and hauling chips or gravel, spreading and rolling chips or gravel, and brooming chips or gravel. The time required to spread asphalt concrete with an

asphalt finisher and to roll this material is important in only a few cases. Assuming normal operations, an asphalt finisher with the required rollers can spread and compact material faster than an asphalt plant can produce asphalt concrete. Therefore, in this chapter, only the plant output capacity will affect the paving time required for a given job.

CONCRETE

Construction of concrete paving includes placing forms, reinforcements, and dowels; mixing, placing, finishing, and curing con-

crete; removing and cleaning forms; cutting or forming joints; pouring joint sealer; and installing expansion joints.

CURBS AND WALKS

Either concrete or asphaltic concrete may be used in the construction of curbs and walks. This construction includes placing forms, expansion joints, reinforcement,

concrete, or asphaltic concrete. It also includes finishing and curing concrete and finishing, priming, and rolling asphaltic concrete.

ESTIMATING TABLES

Use Tables 7-1 through 7-3, pages 7-3 through 7-5, to prepare man-hour estimates for paving, curbs, and walks. These tables

do not include the delivery of materials to the jobsite.

EXAMPLES OF TABLE USE

PROBLEM 1

Four miles of 2-inch thick asphaltic concrete (hot-plant mix) 12 feet wide are to be placed on an existing road surface. The plant supporting this operation averages only 80 tons per hour. Assuming there are enough dump trucks to haul the plant mix, estimate the number of hours required for this paving operation.

Solution. Area to be paved = 4 miles x 12 feet x 5,280 feet/mile x 1 square yard/9 square feet = 28,160 square yards.

From Table 7-2 we find that for a thickness of 2 inches and a plant output of 80 tons per hour under adverse conditions, we require 13 hours/ 10,000 square yards.

Then 28,160 square yards x 13 hours/10,000 square yards = 36.6 hours.

Thus, approximately 37 hours are required.

PROBLEM 2

A prime coat of 0.3 gallon/square yard is to be applied to 3 miles of 18-foot-wide roadway. An 800-gallon, truck-mounted distributor with an 18-foot spray bar and a 1/8-inch nozzle will be used. The average distance to the supply point is 12 miles, and it takes 20 minutes to refill the truck. Estimate the number of hours required for this operation.

Solution. From Table 7-2 we find that at an application rate of 0.3 gallon /square yard, the vehicle moves at a speed of 300 feet per minute and the truck empties in 5 minutes.

Thus, 300 feet per minute x 5 minutes = 1,500 linear feet/truck. 3 miles x 5,280 feet/mile = 15,840 feet/ 1,500 = 10 1/2 (approximately 11 truckloads). This results in 55 minutes of actual spray time. However, travel time to and from the supply point and the time to fill the truck must also be calculated. Assuming an average speed to and from the supply point of 30 miles per hour,

Travel time = 12 miles/30 miles per hour x 2 (round trip) = 48 minutes

Load time given as	20 minutes
Unload time	5 minutes
Average cycle time	= 73 minutes

Must make 11 trips x 73 minutes = 803 minutes/60 = 13.4 hours

Table 7-1. Concrete paving

Work element description	Equipment	Unit	Hours per unit
Formwork: place and remove		100 lin ft	5.5 man-hours
Reinforcing mesh and dowels		100 sq ft	2.0 man-hours
Reinforcing steel and dowels		ton	35.0 man-hours
Mix and place	16S or M919	cu yd	0.02 man-hours
Place ready mix		cu yd	0.4 man-hours
Finish, by hand		1,000 sq yd	324 man-hours
Finish, by machine	Transverse concrete finisher	1,000 sq yds	Gear: 1 - 1.0 machine hour 2 - 0.8 machine hour 3 - 0.7 machine hour 4 - 0.5 machine hours
Place premolded expansion joint		1,000 lin ft	15 man-hours
Cut and form longitudinal and transverse joints	Concrete joint saws	1,000 lin ft	20 man-hours
Place joint sealer		1,000 lin ft	12 man-hours
Cure and clean up		1,000 sq ft	15 man-hours
NOTE: Crew workers: 2 to 3 forming, 4 reinforcing, 6 to 8 mixing and placing, 6 finishing, and 4 sawing and sealing joints.			

Table 7-2. Asphalt paving

This table differs from others because of the unusually short time required to empty an asphalt distributor tank. The application rate depends on the truck speed. The time required varies only with changes in bar lengths. To determine how much area is covered with one full 800-gallon tank, multiply the speed x spray bar length x time required to empty for the square-foot-area covered. However, the most time-consuming part of this operation, which must be considered, is the travel time to and from the refueling point and the time required to refuel (up to 1/2 hour per tank). For larger trucks (1,500-gallon), multiply the time required by 2.

Work element description	Equipment	Unit	Rate of application gallon/sq yd	Time required to empty in minutes		
				Speed ft/min	Spray bar length with 1/8" nozzle	
Apply prime, tack, or seal coat (crew: operator)	800-gal, truck-mounted asphalt distributor	800 gal	0.1 0.2 0.3 0.5 1.0	900 450 300 180 90	12' 7 18' 5 24' 3.5	
Hours per unit asphalt plant output						
				Adverse 80 tons/hr	Average 120 tons/hr	Favorable 150 tons/hr
Spread and finish asphalt concrete	SA35 asphalt finisher ¹	10,000 sq yd	Thickness 1" 2" 3"	6.5 13.0 19.0	4.0 8.0 12.0	3.5 6.7 10.0
Hours required						
			Width applied			
Roll asphalt concrete (crew: operators)	9-14 ton, 3-wheel tandem 5-8 ton, 2-wheel tandem 10 ton, 3-wheel roller 9-tire pneumatic roller	10,000 sq yd	3.2 machine hours 3.4 machine hours 3.0 machine hours 3.1 machine hours			
Spread aggregate (crew: 3 workers)	Standard hopper-type spreader	10,000 sq yd	4' 4.2 machine hours 6' 3.3 machine hours 8' 2.5 machine hours			
Sweep base prior to spraying	30 drawbar horsepower tractor sweeper	10,000 sq yd	4.0 machine hours			
Mix in place and spread 2" bituminous mix (crew: operators)	CAT 130 grader	10,000 sq yd	7.5 machine hours			

¹Maximum recommended operating speed for an SA35 asphalt finisher is about 50 feet per minute. Therefore, 3.5 hours is the minimum time required for a finisher to cover 10,000 square yards. If paving thickness is 3/4 inch or less, use 3.5 hours. (Average crew size = 6 workers on asphalt finisher.)

NOTE: For double-lane roads using one paver, additional time will be required if hot joint construction is desired.

Table 7-3. Paving of curbs and walks

Work element description	Equipment	Unit	Hours per unit
Concrete curbs¹:			
Formwork - Integral with paving		100 lin ft	10.5 man-hours
- Separate from paving		100 lin ft	22.5 man-hours
Combined curb and gutter		100 lin ft	25.5 man-hours
Place reinforcing		ton	35.0 man-hours
Mix and place concrete	16S mixer	cu yd	3.2 man-hours
Mix and place finish top	M919 concrete mobile	100 sq ft	5.5 man-hours
Cure and clean up		1,000 sq ft	1.0 man-hour
Concrete walks²:			
Formwork		100 lin ft	4.5 man-hours
Mix and place (hand)		cu yd	4.5 man-hours
Mix and place	16S mixer	cu yd	3.0 man-hours
Finish	M919 concrete mobile	100 sq ft	5.0 man-hours
Place ready mix		cu yd	1.0 man-hour
Cure and clean up		1,000 sq ft	1.0 man-hour
Asphalt walks³:			
Formwork		100 lin ft	4.5 man-hours
Prime coat		100 sq ft	0.7 man-hour
Spread asphalt	From 165-gallon asphalt kettle	100 sq ft	2.9 man-hours
Roll asphalt	Probably nonstandard equipment - any tired vehicle	100 sq ft	0.6 man-hours
Crew workers:			
¹ 3-4 forming, 2 reinforcing, 4 mixing and placing, and 2 general labor.			
² 3 forming, 6-7 mixing and placing, and 2-3 finishing and general labor.			
³ 3 forming, 3-4 manning kettle, 5 placing, and 1 rolling.			